(No Model.)

2 Sheets—Sheet 1.

M. SHIRES & J. Q. A. KENNEDY.

MACHINE FOR MAKING FIRE ESCAPE LADDERS.

No. 604,797. Patented May 31, 1898.

Fig. 1.

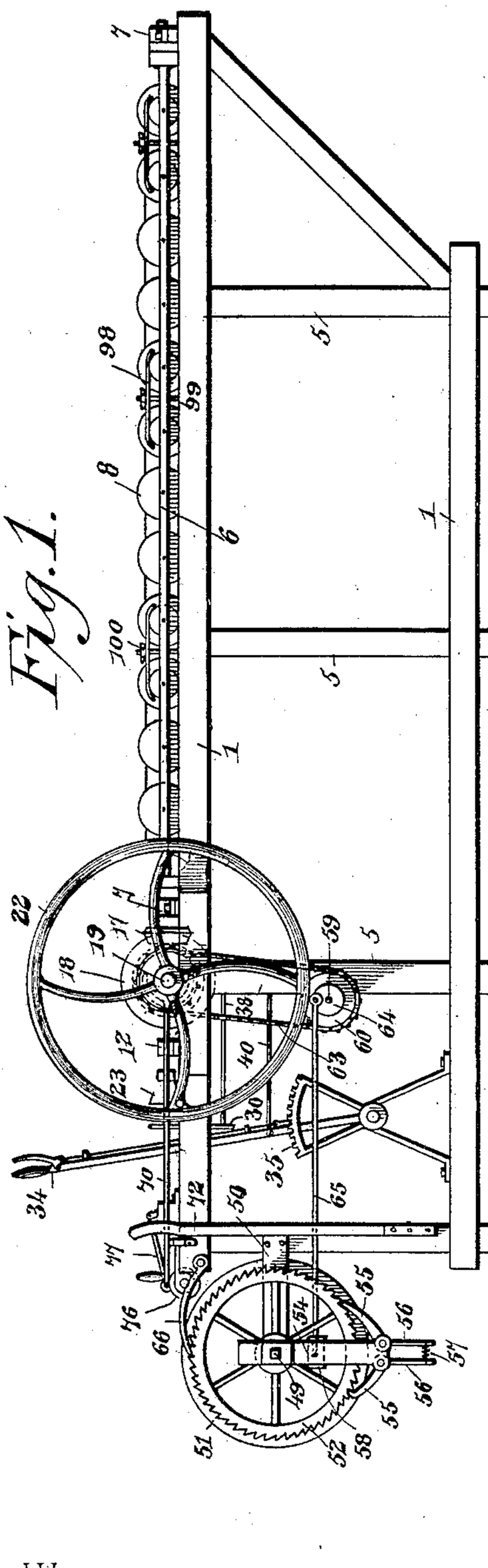


Fig. 10.

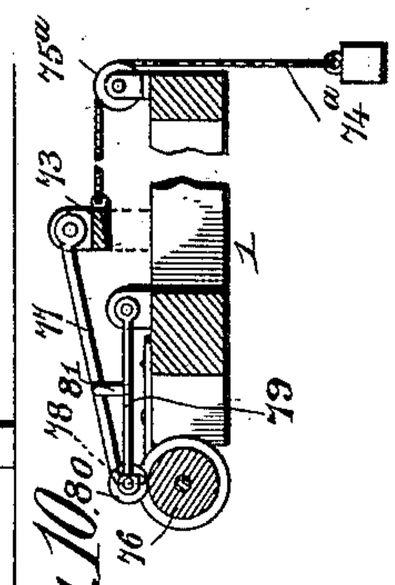


Fig. 6.

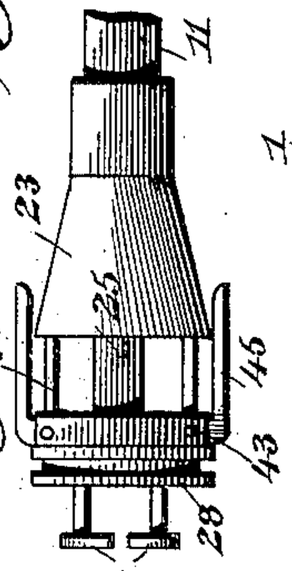


Fig. 12.

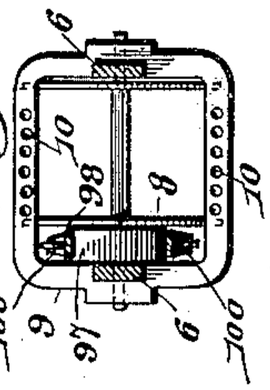


Fig. 11.

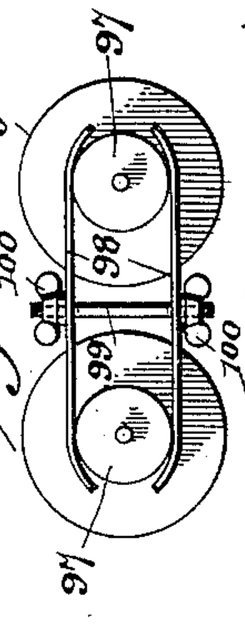
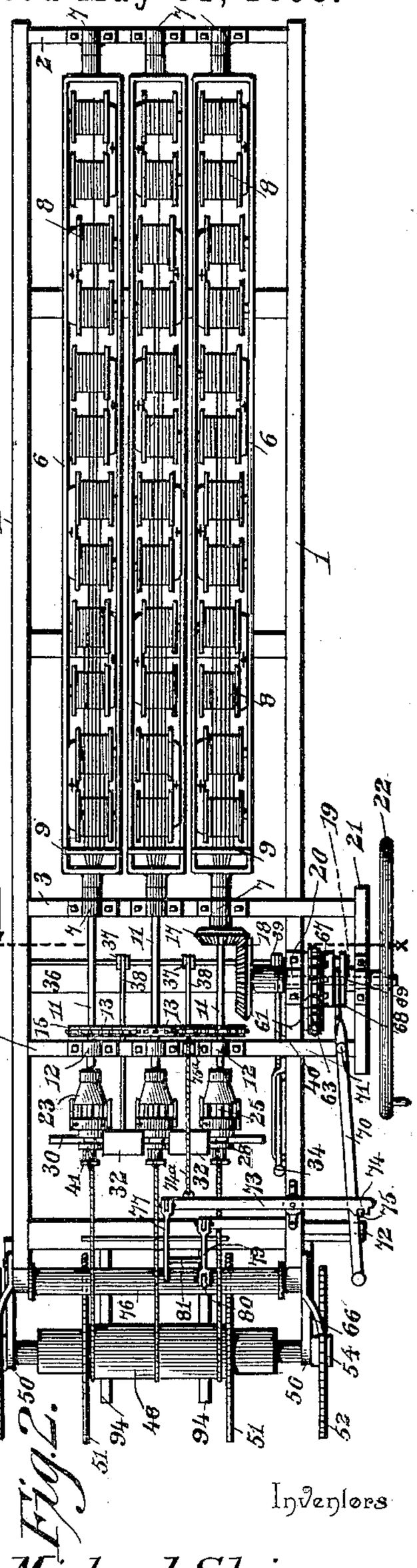


Fig. 2.



Inventors

Michael Shires

By their Attorneys, John Q. A. Kennedy

C. A. Snow & Co.

Witnesses

Jas. K. McCathran

Edwin Cruse.

(No Model.) 2 Sheets—Sheet 2.

M. SHIRES & J. Q. A. KENNEDY.

MACHINE FOR MAKING FIRE ESCAPE LADDERS.

No. 604,797. Patented May 31, 1898.

Fig. 3.

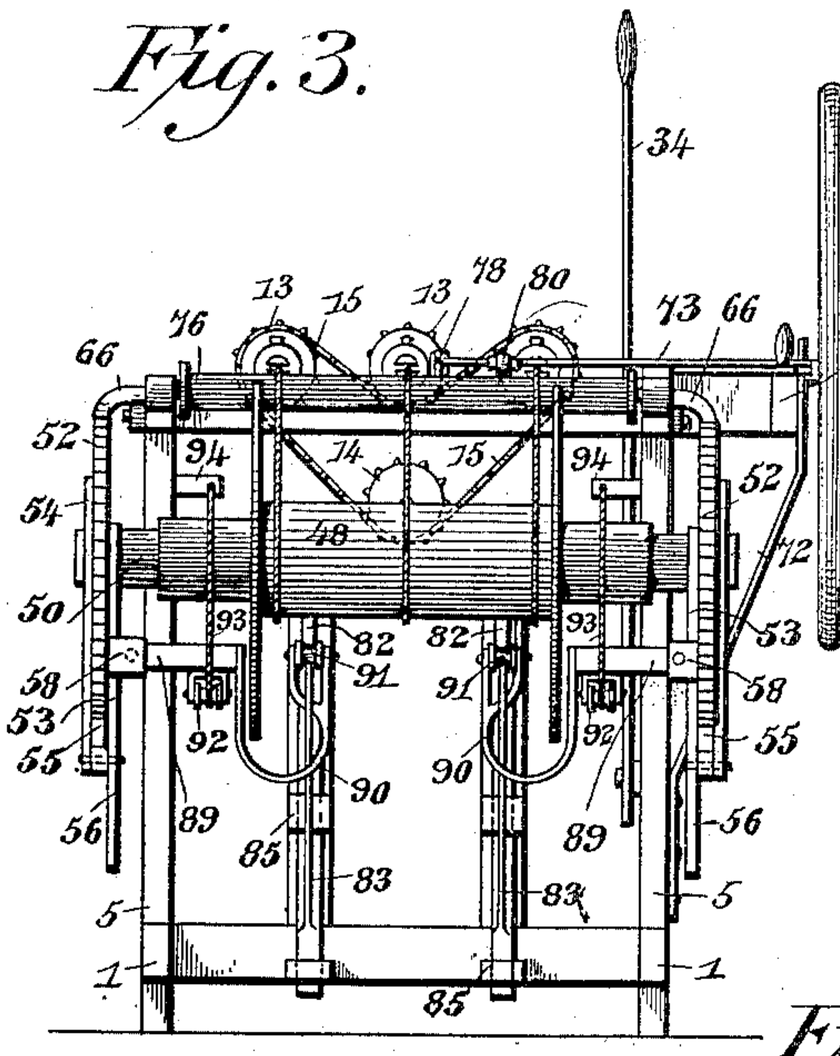


Fig. 5.

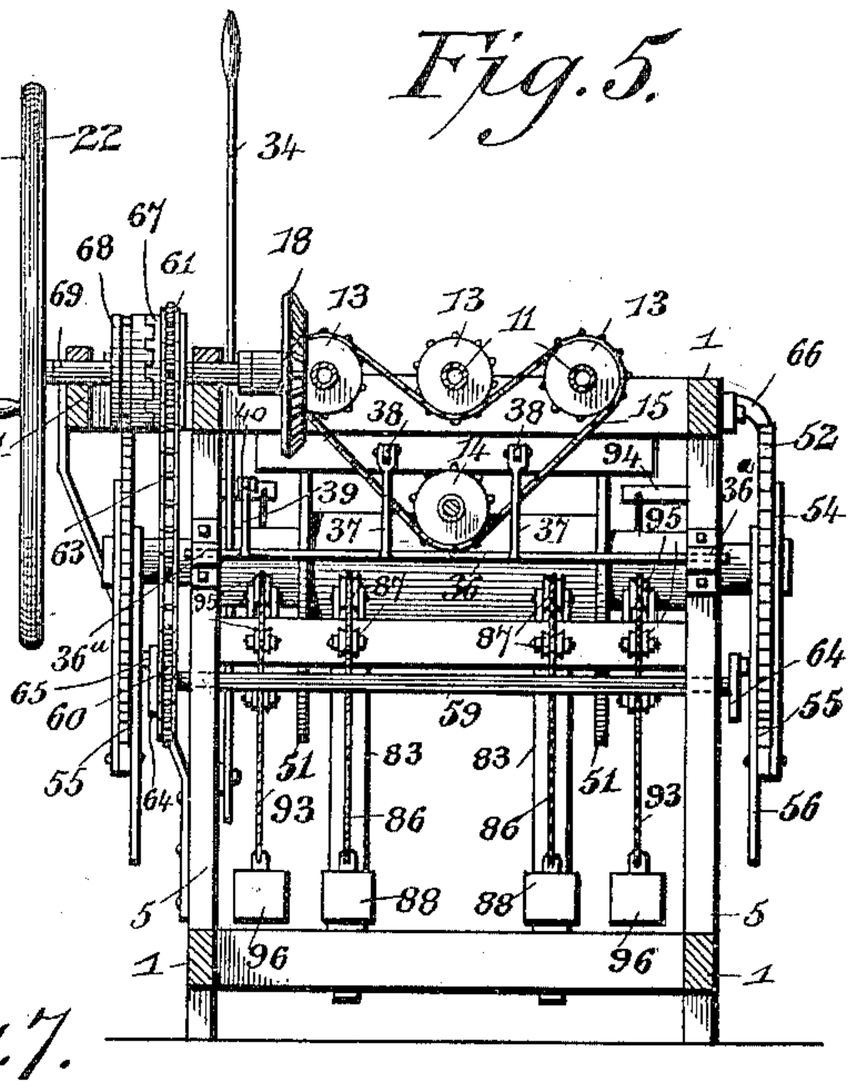
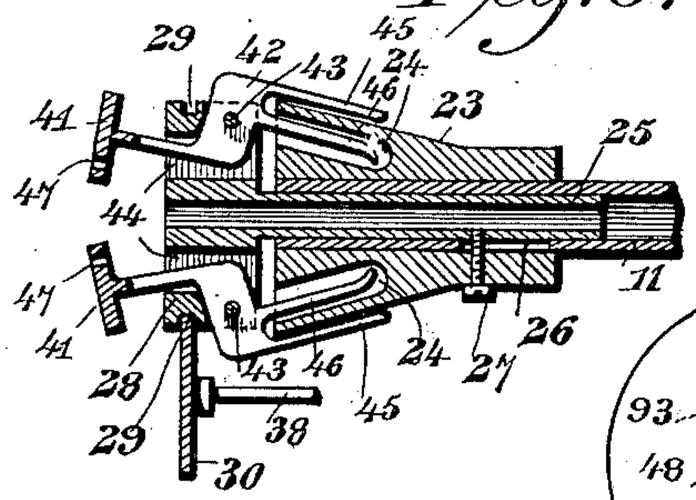


Fig. 7.

Fig. 8.



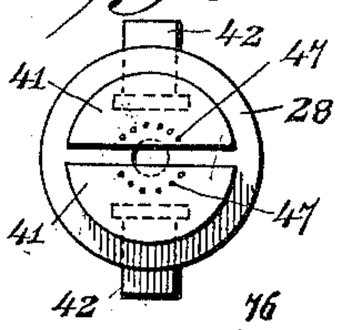


Fig. 4.

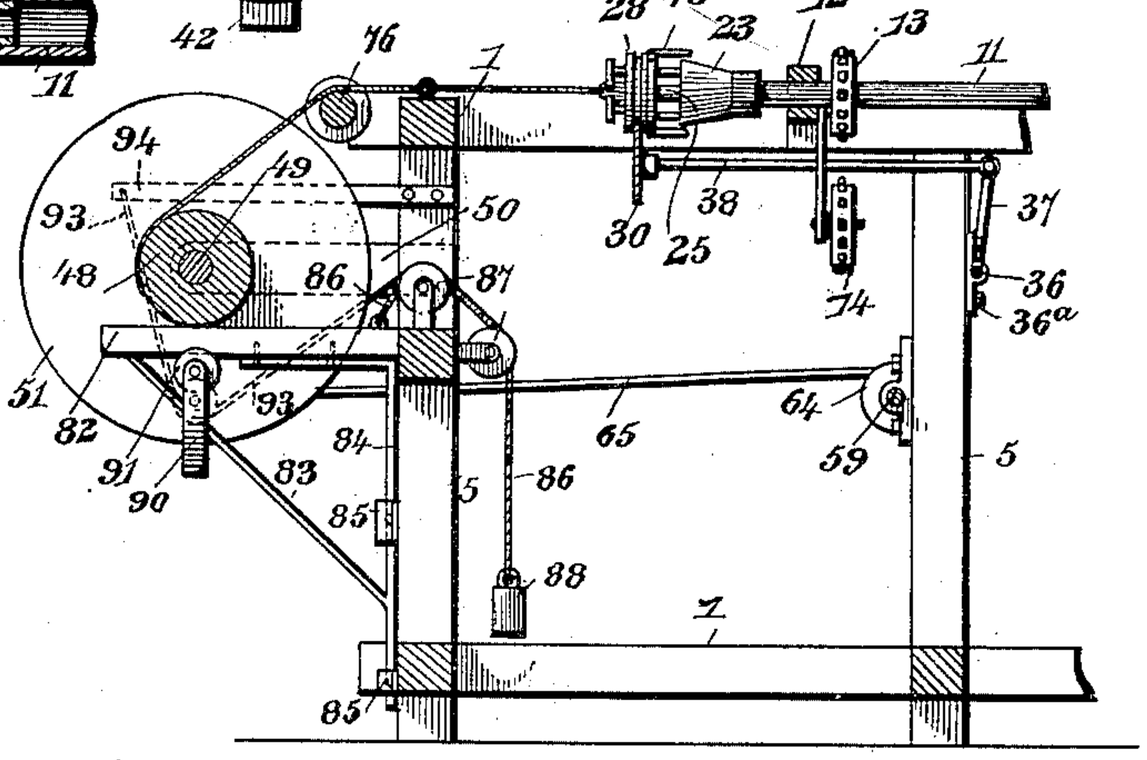
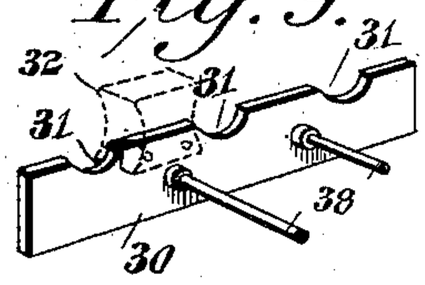


Fig. 9.



Inventors

Witnesses

Jas. K. McCathran

Edwin Cruse.

By their Attorneys, John Q. A. Kennedy

Michael Shires

Cachow & Co.

UNITED STATES PATENT OFFICE.

MICHAEL SHIRES, OF SPRING MILLS, AND JOHN Q. A. KENNEDY, OF JOHNSTOWN, PENNSYLVANIA, ASSIGNORS TO THE JOHNSTOWN FIRE ESCAPE COMPANY, LIMITED, OF JOHNSTOWN, PENNSYLVANIA.

MACHINE FOR MAKING FIRE-ESCAPE LADDERS.

SPECIFICATION forming part of Letters Patent No. 604,797, dated May 31, 1898.

Application filed August 4, 1897. Serial No. 647,099. (No model.)

To all whom it may concern:

Be it known that we, MICHAEL SHIRES, residing at Spring Mills, in the county of Centre, and JOHN Q. A. KENNEDY, residing at Johnstown, in the county of Cambria, State of Pennsylvania, citizens of the United States, have invented a new and useful Machine for Manufacturing Fire-Escape Ladders, of which the following is a specification.

This invention relates to certain improvements in machines for manufacturing fire-escape ladders, the nature and objects of which will be fully set forth in the following specification and the novel features thereof be particularly pointed out in the subjoined claims.

In the drawings, Figure 1 is a side elevation of a machine made in accordance with our invention. Fig. 2 is a plan view. Fig. 3 is a front end view. Fig. 4 is a vertical longitudinal section through that part of the machine in advance of the spool-carriers. Fig. 5 is a vertical transverse section on the line *x x* of Fig. 2, looking toward the front of the machine. Figs. 6, 7, and 8 are respectively side, end, and sectional views of the devices to spread the wires for the insertion of the rungs, detached. Fig. 9 is a detached detail view of the bar to move the disks which carry the spreading-jaws. Fig. 10 is a sectional detail of the tripping device operated by the rungs. Fig. 11 is an enlarged view of the tension device for the spools. Fig. 12 is an elevation of the guide at the front end of the spool-frame.

Similar reference-numerals indicate similar parts in the several figures.

The frame of the machine is of rectangular oblong form and consists of the upper horizontal rails 1, which are connected by the cross-bars 2, 3, and 4, and the rails and bars are supported by the vertical standards 5, which are suitably braced in any approved manner.

6 indicates the spool-frames, which are journaled in suitable bearings 7 on the cross-bars 2 and 3. The spool-frames are arranged side by side and parallel to each other in such manner that each is free to revolve without coming in contact with the others, and each spool-frame carries a series of spools, (indicated by 8.) As shown in the drawings, twelve of these spools are used, although the number may be more or less, as desired. Each frame carries at its front end a guide 9, which is provided with upper and lower series of perforations, (indicated by 10.) There are six perforations in each series, and the wires from one-half the spools pass through the lower series of perforations, while the wires from the other spools lead through the upper series of perforations.

11 indicates tubes which are rigidly connected to the front ends of the respective spool-frames, and these tubes are supported at their front ends in suitable bearings 12 on the cross-bar 4. Each of these tubes is provided with a sprocket-wheel 13, which is rigidly connected to it, and immediately below the sprocket-wheel, on the middle tube, another sprocket-wheel 14 is suitably journaled on the frame, and this sprocket-wheel 14 runs as an idler.

15 indicates a sprocket-chain which runs under the idle sprocket-wheel 14 and also under the sprocket-wheel on the middle tube and over the sprocket-wheels on the two outer tubes. By this arrangement of gearing the outer tubes are revolved in one direction and the middle tube in the reverse direction, and the object of this arrangement is to twist the middle wire cable in the opposite direction to the twist in the two outside cables for the purpose of preventing the ladder from twisting when suspended from a window. One of the outer tubes is provided with a beveled pinion 17, which meshes with a beveled gear 18 on a shaft 19, which is supported in suitable bearings 20 on one of the side rails 1 and a short bar 21, rigidly connected to the ends of the cross-bars 3 and 4. The shaft 19 also carries at its outer end a hand-wheel 22, and it is obvious that by turning the hand-wheel 22 the several spool-frames will be revolved through the medium of the beveled gearing and the sprocket-wheels and the chain before described.

Each of the tubes 11 carries at its forward end a cone 23, and each of these cones is provided with oppositely-arranged recesses 24,

extending longitudinally into the cone and parallel with its outer face, the object of which recesses will be referred to hereinafter. Each tube 11 also supports a tube 25, which is free to have longitudinal movement therein, and the tube 11 is provided with a slot 26, and the tube 25 is provided with a key 27, which fits in the slot 26, and the two tubes 11 and 25 are thereby caused to have a common rotary movement at the same time the tube 25 is free to have limited longitudinal movement in the tube 11. Each of these tubes 25 carries a disk 28 at its outer end, and these disks are each provided with an annular groove 29.

30 indicates a bar which is provided with three semicircular recesses 31, and these recessed portions fit into the annular grooves 29 in the disks 28. The bar 30 is supported on the under side of the disk by means of blocks 32, which are connected to the bar 30 and are provided with semicircular recesses at their ends to partially embrace the disks 28 on their upper sides in such manner that the disks are left free to revolve.

34 indicates a latch-lever which is pivoted at its lower end on a quadrant 35, and the latter is supported in any suitable manner on the frame of the machine.

36 indicates a rod which is journaled in suitable bearings 36ª on two of the vertical standards 5, and this rod is provided with two integral arms 37, which are connected by rods 38 to the bar 30. The rod 36 is also provided with an arm 39, which is connected by a rod 40 to the lever 34. It is obvious, therefore, that by rocking the lever 34 the disks 28 will be caused to move toward or away from the cones 23 on the tubes 11.

41 indicates wire-holding jaws which are provided with arms 42, pivoted at 43 in suitable recesses 44, formed in the disks 28. The rear ends of the arms 42 are bifurcated, and one prong 45 is straight, while the other prong 46 is curved at its outer end. The prongs 46 project into the recesses 24 in the cones 23, while the prongs 45 are adapted to work on the outer face of the cone, and by this construction when the disks 28 are moved toward the cones 23 the two wire holders or jaws 41 will be forced apart for a purpose to be hereinafter referred to. Each of these holders or jaws 41 is provided with a semicircular series of perforations, (indicated by 47,) and there are six of these perforations in each series. The wires from the spools, after passing through the perforations in the guides 9, pass through the tubes 25 and then through the perforations in the jaws 41, each jaw carrying six wires.

48 indicates the drum on which the completed ladder is wound, and the shaft 49 of the drum is journaled in suitable bearings in the arms 50, which extend horizontally from the front end of the main frame of the machine. The drum is provided with spaced flanges 51. The shaft 49 carries at each end a ratchet-wheel 52, said wheels being fast on the shaft, and on each side of these disks arms are loosely mounted at one end on the shaft and extend downward in a vertical direction. The inner arms are indicated by 53 and the outer arms by 54, and between these arms, at their lower ends, are pivoted the pawls 55, each pawl having an arm 56, which extends downwardly, and a spring 57 is secured between the lower ends of these arms and tends normally to hold the pawls in engagement with the teeth of the ratchet-wheels. Each of the inner arms 53 carries a head 58, which is adapted to slide vertically on its arm, for a purpose to be hereinafter referred to.

59 indicates a shaft which is journaled in suitable bearings on the frame of the machine and extends transversely across it in substantially vertical alinement with the shaft 19. A sprocket-wheel 60 is secured on the shaft 59 at one end in alinement with a similar sprocket-wheel 61 on the shaft 19, and these two sprocket-wheels are connected by a chain 63. The shaft 59 also carries at each end a crank-disk 64, and these crank-disks are connected to the respective sliding heads 58 by rods 65. When the shaft 19 is rotated, the shaft 59 will also be rotated and the connection between the crank-disks 64 and the sliding heads 58 will cause the arms 53 and 54 to reciprocate and thereby impart rotary movement to the ratchet-wheels 52 and the drum 48.

66 indicates dogs pivoted to the frame of the machine and engaging the teeth of the ratchet-wheels 52 to prevent backward movement of the drum.

There is a clutch connection between the shaft 19 and the hand-wheel 22, and one member 67 of this clutch is fast on the shaft 19. The other member 68 is slidably supported on a sleeve 69, which projects from the hand-wheel and through which sleeve the shaft 19 extends. The clutch member 68 is so connected to the sleeve 69 that they will have common rotation, but the clutch member will have a limited movement on the sleeve longitudinally.

70 indicates a strap-lever which is pivoted intermediate its ends to the cross-bar 4, as indicated at 71. One end of this strap-lever is connected to the movable member 68, and the free end of the lever is engaged by a spring 72, which is secured to the frame of the machine and tends normally to hold the clutch members disengaged.

73 indicates a lever which is pivoted intermediate its ends on the side rail 1 and is provided with a recess 74 in its outer end, which engages with a lug 75 on the lever 70, and when the lug is engaged in the recess 74 the clutch members will be locked together. A weighted rope 74ª is connected to the inner end of the lever and runs over a guide-pulley 75ª, suitably mounted on the frame at any convenient point to hold the levers 70 and 73 in engagement.

76 indicates a roller extending transversely

of the machine-frame and suitably journaled therein, and over this roller the completed ladder is drawn on its way to be wound on the drum 48. An arm 77 (see Fig. 10) is pivotally connected at one end to the inner end of the lever 73 and is provided at its free end with a hook 78, which is immediately above the roller 76.

79 indicates an arm which is pivoted at one end to a fixed part of the machine and is provided at its free end with a roller 80, which normally engages the roller 76. The two arms 77 and 79 are connected by a bar 81. The roller 80 is somewhat in advance of the hook 78, and when this roller is in engagement with the roller 76 the hook will be held out of contact with the roller 76 and cannot therefore injure it.

As the completed ladder is wound on the drum the rungs of the ladder will successively engage the hook 78, and when a rung engages the hook 78 the arm 77 will be drawn slightly forward and rock the lever 73 on its pivot sufficiently to disengage the lug 75 from the recess 74, when the spring 72 will operate the lever 70 and disengage the clutch members and thereby stop the machine. As soon, however, as the rung engages the roller 80 it will lift the hook 78 out of engagement with the rung and permit the latter to pass onward to the drum when the machine is again started.

As the completed ladder is wound upon the drum 48 it will become necessary to vary the speed at which the drum is rotated, and in order to accomplish this we provide bars 82, which are secured to brackets 83, the vertical members 84 of which brackets are supported in guides 85, secured to the frame of the machine in such manner that the brackets and bars 82 may have a sliding vertical movement. To the rear end of each of these bars 82 a rope 86 is connected, and this rope passes over suitable guide-pulleys 87, mounted on the frame of the machine, and is provided at its free end with a weight 88. The tendency of these weighted ropes is to hold the bars 82 in engagement with the drum or with the outer layer of the ladder as it is wound upon the drum. From each of the heads 58 an arm 89 extends inwardly toward the flanges 51 of the drum.

90 indicates U-shaped bars which straddle the flanges of the drum and are secured at one end to the inner end of the respective arms 89. The other ends of these U-shaped bars are bifurcated and support rollers 91, which engage the lower faces of the bars 82. Pulleys 92 are journaled in suitable bearings secured on the lower faces of the arms 89, and ropes 93 run under these pulleys and are connected at one end to arms 94, projecting from the frame of the machine. The other ends of these ropes, after passing over guide-pulleys 95, are provided with weights 96. As the completed ladder is wound upon the drum the bars 82 will be gradually forced downwardly and will carry with them the heads 58, and as the heads 58 move gradually down the arms 53 the length of stroke of the lower ends of the arms 53 and 54 will be gradually decreased, and consequently the drum will be rotated at gradually-decreasing speed.

In order to regulate the tension of the wires as they pass from the spools, each of the spools 8 is provided at one end with a collar 97.

98 indicates a pair of bars, preferably of spring metal, and these bars are arranged to engage the collars on each pair of adjacent spools, and a bolt 99 connects the bars midway their length, and the pressure of the bars upon the collars is regulated by the thumb-screws 100, which work on the bolt and engage the respective bars.

The operation of the machine is as follows: The wires from the several spools, after passing through the guides 9, extend through the tube 25, and thence pass through the wire-holding jaws 41, six wires being supported by each jaw. After the ends of the wires have been twisted sufficiently to secure them firmly together the lever 34 is operated to cause the jaws 41 to spread apart, which will result in opening the wires sufficiently to permit the insertion of a rung between them. The lever 34 is then retracted and the hand-wheel turned, which latter causes the spool-frames, the tubes, and the jaws to have uniform rotary movement, and thereby twist the wires which form the cables. At the same time the drum will be rotated and that portion of the ladder which is already completed will be wound thereon until a rung engages the hook 78 on the arm 77, when the lever 70 will be released and disengage the clutch members, thereby stopping the rotation of the spool-frames and also of the drum. The lever 34 will then be again operated to open the jaws 41 for the reception of another rung, and the operation will then continue as before.

While the machine contemplated by this invention has been described as especially adapted for use in manufacturing fire-escape ladders, still it will be understood that the machine can be utilized for manufacturing similar woven structures—such, for instance, as picket fencing—without any change whatever in the construction or operation of the machine. In this connection it will be obvious that the twisted wire cables formed by the machine could well be the wire cables of a fence, while ordinary fence pickets or panels could be substituted for the ladder-rungs which are used during the process of weaving a line of fire-escape ladder. The operation in either case would be identical, so we desire it to be understood that although the machine is especially designed for manufacturing fire-escape ladders yet the same can be utilized for wiring wood fencing and manufacturing other analogous woven structures.

In using the machine for manufacturing fire-escape ladders or other analogous structures it may be necessary to modify or rearrange some parts thereof; but we reserve the

right to make any changes or modifications in the machine, such as may be necessary to adapt the same for any particular work, without departing from the spirit or sacrificing any of the advantages of this invention.

Having thus described the invention, what we claim is—

1. In a machine for manufacturing fire-escape ladders, the combination of a spool-carrying frame, a tube connected to the frame and through which the wires pass from the spools, a pair of jaws pivotally connected to the tube and provided with perforations through which the wires pass, devices to open said jaws to separate the wires for the insertion of a rung, and means to rotate the spool-frame and the jaws, substantially as described.

2. In a machine for manufacturing fire-escape ladders, the combination of the spool-carrying frames, tubes rigidly connected to the frames, recessed cones carried by said tubes, inner tubes slidably supported in the first-named tubes to rotate therewith, disks carried by the said inner tubes, a pair of jaws pivoted in each of said disks, each jaw having perforations through which the wires pass, curved arms on said jaws working in the recesses in the cones, means to reciprocate the inner tubes to open or close the jaws, and means to rotate the spool-frames, the tubes, and the jaws, substantially as described.

3. In a machine for manufacturing fire-escape ladders, the combination of the spool-carrying frames, wire-twisting devices carried by the frames, gearing to rotate the frames and twisting devices simultaneously, a driving-wheel, a clutch connection between said gearing and the driving-wheel, a drum on which the completed ladder is wound, and mechanism operated by the successive rungs of the completed ladder to disengage the members of said clutch, substantially as described.

4. In a machine for manufacturing fire-escape ladders, the combination of spool-carrying frames, wire-twisting devices carried by the frames, gearing to rotate the frames and twisting devices simultaneously, a driving-wheel, a clutch connection between said gearing and the driving-wheel, a drum on which the completed ladder is wound, a roller journaled in the frame over which the completed ladder moves to the winding-drum, a spring-actuated pivoted lever connected at one end to the movable member of the clutch, a locking-lever pivoted on the frame and engaging at one end the spring-actuated lever to hold the clutch members locked, an arm pivotally connected to the other end of said locking-lever and projecting over the said roller to be engaged by the successive rungs of the completed ladder to trip the locking-lever and release the clutch mechanism, substantially as described.

5. In a weaving-machine of the class described, the combination with the twisting mechanism; of the drum for the woven structure, ratchet mechanism arranged on the drum-shaft and having a swinging pawl-carrying arm, a normally-elevated movable support carrying a head slidably engaging said pawl-carrying arm, and a normally-elevated movable contact-bar arranged beneath the drum and engaging with said movable support, substantially as set forth.

6. In a machine for manufacturing fire-escape ladders, the combination of the wire-twisting devices, the drum on which the completed ladder is wound, a ratchet-wheel on the shaft of the drum, an arm pivoted at one end on the drum-shaft, a spring-pawl carried by the arm to engage the teeth of the ratchet-wheel, a sliding head on the arm, means connected to the sliding head to oscillate said arm to turn the wheel and drum, a sliding bar arranged below the drum transversely thereof and adapted to be engaged and moved by the completed ladder as it is wound on the drum, a weight to normally hold the bar in contact with the woven structure on the drum and connections between said bar and the sliding head, substantially as described.

7. The combination of the wire-twisting devices, the flanged drum on which the completed ladder is wound, a ratchet-wheel rigid on the shaft of the drum, an arm pivoted at one end on the drum-shaft, a spring-pawl carried by the arm to engage the teeth of the wheel, a sliding head on the arm, means connected to the sliding head to oscillate said arm to turn the ratchet-wheel and drum, a bracket supported on the frame to have vertical movement, a bar carried by the bracket and extending across below the drum, a weight to hold the bar normally in engagement with the completed ladder on the drum, a U-shaped bar straddling the flange of the drum and connected at one end to the sliding head, a pulley journaled on the other end of said U-shaped bar to engage the bar carried by the bracket, whereby the position of the head is changed as the ladder is wound on the drum and the speed of the drum thereby decreased, substantially as described.

8. In a machine for manufacturing fire-escape ladders, the combination of the wire-carrying spools, collars secured at one end to said spools, a pair of bars engaging the collars on adjacent pairs of spools, a bolt connecting said bars midway their length, and thumb-nuts on said bolt to regulate the pressure of the bars on the collars, substantially as described.

9. In a weaving-machine of the class described, the combination of a spool-holder, and the twisting device having means for separating the strands of wire, and causing the latter to approach and recede from the axis of rotation, substantially as set forth.

10. In a weaving mechanism of the class described, a rotatable twisting device having wire-holders each provided with a plurality of perforations for threading the wire strands therein, and means for causing the two sets

of wire strands to approach and recede from the axis of rotation.

11. In a weaving-machine of the class described, a rotatable twisting device having wire-holders each provided with a plurality of perforations for threading the wire strands therein, and means for simultaneously adjusting said holders to cause the sets of strands carried thereby to approach and recede from the axis of rotation.

12. In a weaving-machine of the class described, a rotatable twisting device having a pair of movable wire-holders, and means for causing said holders to move in a direction toward and away from each other.

13. In a weaving-machine of the class described, a rotatable twisting device having a pair of pivotal wire holders or jaws provided each with a plurality of wire openings or perforations, and means for oscillating said holders or jaws on their pivots.

14. In a weaving-machine of the class described, the combination with the twisting mechanism for the parallel cables, of a rotatable drum for the woven structure, and means for automatically stopping the rotation of said drum and the operation of the twisting mechanism when a certain predetermined length of the woven structure is complete.

In testimony that we claim the foregoing as our own we have hereto affixed our signatures in the presence of two witnesses.

MICHAEL SHIRES.
JOHN Q. A. KENNEDY.

Witnesses:
HORACE R. ROSE,
W. S. HOCKING.